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IoT Based Smart Kitchen using MQ-7 and PIR Sensor

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ABSTRACT

People's daily life has become easier due to the rapid technological development and adoption in recent years. The kitchen is a common and important place in a house which is getting automated day by day. Now-a-days the kitchen is getting smarter with the blessings of IoT and AI technologies. Safety is the main concern that must always be ensured in the kitchen. Unwanted gas and water leakage, sudden fire, excessive temperature rise, and humid environment should be identified immediately, and necessary measures should be taken. Security at home is a great issue where unwanted gas and water leakage, sudden fire, excessive temperature rise can have a threatening consequence. A gas leak can suffocate people in small, confined areas and ignite a fire, which can be more dangerous. The MQ-7 sensor is used to detect unwanted gas (Carbon monoxide gas) leakage inside the kitchen that can save the kitchen from above mentioned situation. When MQ-7 detects gas in the kitchen, the buzzer instantly activates and starts to play. Additionally, the PIR sensor is used to sense the existence of humans inside kitchen and the light become on, which saves power. Arduino IDE and ESP32 board were used to build the system.

Keywords: Smart Kitchen, Arduino IDE, ESP32, MQ-7 Sensor, PIR Sensor.

I. INTRODUCTION

The development of ICT, internetworking technologies, and Internet of Things (IoT) have a positive impact in humans' daily life, where IoT and internetworking technologies bring changes in modern society in positive direction. IoT is a technology that allows physical devices to interact with each other's, machine-to-machine, and machine-to-human communication. This feature enables automation without humans using computer programming and programming the IoT devices. The goal of embedded systems and IoT is to build human life smooth and easier using technology, where the physical devices can act automatically without the human orders. Humans perform a lot of activities in home at daily life. The kitchen is the room in the house that needs a lot of electronic machinery, and all

the work should be done carefully with those machines. The handling of all the items with care is a significant consideration. A kitchen is one place in a home where people do activities related to preparing food. Activities related to cooking foods changed the environments of the kitchen room. The factors related to kitchen room are temperature, gas, light, humidity and so on. Kitchen room activities will increase temperatures, and carbon monoxide. Along with this, there is a high risk of fire due to gas burners.

People can greatly benefit from a Smart Kitchen room outfitted with modern technological innovations in their daily lives by avoiding any hazard brought on by gas leaks, water leaks, humid environment, etc. A cutting-edge technology called Smart Kitchen includes various interactive services for the safety of the kitchen room. Homes are getting more intelligent and cost-effective as innovations and technology developments are implemented, and this trend is continuing with household goods [1]. Traditional switches are rapidly being replaced in modern homes with centralized control systems that comprise remote-controlled switches with other necessary devices [2]. The technology in smart kitchens offers the user the convenience of controlling their kitchen equipment from their smartphone. The Android app allows users to remotely operate their home appliances.

II. LITERATURE REVIEW

All recent research methodology, findings, problems, challenges with smart kitchen are summarized in this section. The Internet of Things (IoT) is the latest development of the current Internet that enables technology to interact, communicate, and use the Internet. Smart kitchens need a reliable, uncomplicated, and autonomous network architecture to help with management and reduce the risks related to IoT based smart kitchen. The authors [3] presented a system in which they use the Internet of Things (IoT) for home grocery monitoring system as the sensors are involved in detecting the behaviours connected with grocery replenishment and analysing the data to track and predict the grocery demand for a smart kitchen. Researchers have proposed and designed a variety of sophisticated kitchen safety and security solutions systems using IoT based technologies. At present, there is a prime need to ensure the security and safety of the kitchen. Systems were designed and developed to provide users with numerous options for viewing, managing, controlling, and keeping track of kitchen data [4]. Researchers in [5] have employed a number of technologies, including sensors, ZigBee, databases, embedded tools, Web applications, and mobile development to monitor the kitchen. The authors of [6] employed an alarm to warn the occupants and installed Internet protocol webcams so that residents could check the gas burner from their phones to address kitchen safety concerns.

III.SYSTEM REQUIREMENT

To design and develop a smart kitchen, the following hardware and software are deployed. Arduino IDE and Python programming language are used in a Windows PC.

Hardware requirement:

- ESP32
- MQ-7 sensor
- PIR sensor
- Buzzer,
- Mini Pushbutton switch
- DC-DC Converter with 7-segment display
- DC jack
- Transistor
- LED
- Axial fan
- jumper wire and breadboard.

The abovementioned hardware devices are described below.

A. **ESP32 Board**

ESP32 is a low low-power and low-cost system on a chip microcontroller with Wi-Fi and Bluetooth. It is ideal for applications with low energy. Its clock frequency is 80-240 MHz and Wi-Fi frequency is 2.4-2.5 GHz. A Sample image of ESP32 board is shown in Figure 1.

Figure 1. ESP32 board.

B. **MQ-7 Sensor**

The MQ-7 gas sensor module is a carbon monoxide (CO) gas sensor module that is very suitable to sense gas in the air. It operates at 3-5V DC and resolution range from 20-2000 ppm. Figure 2 shows the MQ-7 carbon monoxide gas sensor.

Figure 2. MQ-7 gas sensor module.

C. **PIR Sensor**

It is a motion detecting sensor that typically picks up infrared radiation from moving people. The PIR sensor image is shown in Figure 3. This sensor is typically used to detect intrusions or the motions of live things.

Figure 3. PIR Sensor.

D. **DC-DC Converter 7 Segment Display**

This DC-DC Buck Converter with 7-Segment displays (LM2596) the current input and output voltages in Figure 4. The LM2596 step-down switching regulator is capable of current up to 3A, with an adjustable output voltage of 1.25-30V via the trim pot.

Figure 4. DC-DC Buck Converter with 7-Segment displays.

E. **DC Jack**

A DC power jack (shown in Figure. 5 (a)) is responsible for receiving power and is usually mounted on the PCB or chassis of an electronic device. DC power receptacles are also intended to receive

power but are instead found on the end of a power cord.

(a) (b)

Figure 5. (a) represent DC jack and 5(b) shows transistor.

E. Power Transistor

The TIP120 (shown in 5(b)) is an NPN Darlington Power Transistor. It can switch loads up to 60V with a peak current of 8A and a continuous current of 5A. This makes it suitable for medium and high-power electronics like controlling motors, solenoids, or high-power LEDs.

IV. METHODOLOGY

In this system, MQ-7 (carbon monoxide gas) sensor is used to detect gas leakage inside the kitchen. When the gas spills in the kitchen, the MQ-7 sensor detects its presence and the buzzer located inside the kitchen automatically warns and the axial fan becomes on to ventilate the gas. When the PIR sensor senses any human movement inside the kitchen, the light comes on which saves energy wastage. Arduino IDE (Integrated Development Environment) and Python IDLE (Integrated Development and Learning Environment) were used to implement the project. Arduino IDE is open-source software which makes easy coding and then uploads to ESP32 board [7]. The Shell window and the Editor window are the two primary window types in Python IDLE. It is possible to run more than one editor window at once. Python's integrated development environment (IDLE) [8].

Figure 6. Screenshot from Arduino.

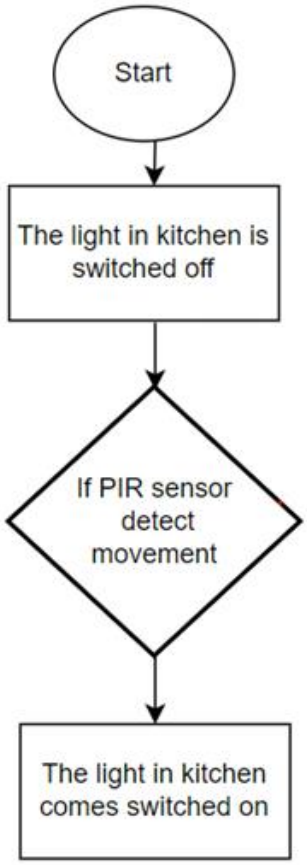

Figure 7. Flowcharts for switch of light in the kitchen becomes on when PIR sensor sense human activity.

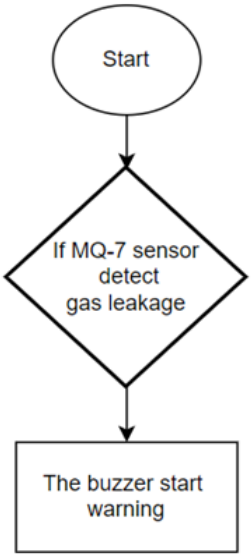

Figure 7. Flowcharts buzzer warning in the kitchen when MQ-7 sensor sense gas leakage.

V. CONCLUSION

Smart kitchen is a cooking room with connected appliances through Bluetooth or Wi-Fi. In smart kitchen, the equipment connects to other devices, such phone or tablet, and enables remote control of appliances by the users. In kitchen room, safety is the main concern that must be ensured. In smart kitchens, safety measures are considered and solved using various recent technologies. The smart kitchen project implemented using ESP32 board and Arduino IDE. MQ-7 sensor is used to detect sudden gas leakage and warns using buzzer. The power energy wastage is reduced by using PIR sensor by sensing human activity in the kitchen and room light turns on.

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